FAA-C-2440
February 2, 1970

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION SPECIFICATION

CONSTRUCTION OF AIRPORT SURVEILLANCE RADAR FACILITY, MODEL ASR-7

DIVISION 1. GENERAL REQUIREMENTS

1-1 Summary of Work

1-1.1 Scope.- This specification covers the requirements for the construction of an Airport Surveillance Radar facility, ASR-7, consisting of a radar antenna support tower, radar transmitter/receiver building, emergency engine-generator system, access road, and supporting utilities. Installation and wiring of electronic equipment are not included.

1-1.1.1 Specification contents.- This specification has been prepared in accordance with The Construction Specifications Institute format, and Divisions 4, 6, 7, 8, 9, 10, 11, 12, 14, and 15 are not required. The scope of work involves Division 1, and Divisions 2 - Site Work, 3 - Concrete, 5 - Structural Metal, 13 - Special Construction, and 16 - Electrical.

1-1.2 Applicable Documents

1-1.2.1 FAA documents.- The following FAA specifications and drawings, of the issues specified in the invitation for bids, form a part of this specification and are applicable to the extent specified herein.

1-1.2.1.1 FAA specifications.-

FAA-C-95	Driveway Construction, Gravel Surfaced
CAA-566	Concrete
FAA-C-1217	Electrical Work, Interior
FAA-C-1244	Installation of Engine-Generator and Fuel Tanks
FAA-1247	Erection of Self-Supporting Towers
FAA-1391	Installation and Splicing of Underground Cable
FAA-E-2065	Fences
FAA-E-2022	Substation, Power Distribution Transformer, Metalclad

1-1.2.1.2 FAA drawings.-

D-5825	Airport Surveillance Radar, ASR-7, Typical Site Layout
D-5826-1 thru -4	Airport Surveillance Radar, ASR-7 Building Foundation
D-5419-1 thru -12	Airport Surveillance Radar, ASR-4 Tower, Design and Installation Drawings
D-5453-E1 thru E16	Airport Surveillance Radar, ASR-4 Tower, Erection
D-5468-2	Metalclad Transformer Substation, 45 or 75 KVA - 3 Phase, Installation Details
C-5186	Transformer Pad for Metalclad Substations, Structural Details
D-5816-1	Housing, Van Type, Skid Mounted, Up to 65 KVA Engine Generator, Plans, Elevations and Details
D-5816-3	Housing, Van Type, Skid Mounted, Up to 125 KVA Engine Generator, Foundation Details
D-4863-1	Standard Underground Handholes Construction Details
D-4780	Radar Handhole and Duct Details

1-1.2.2 Other publications.- The following publications, of the the issues in effect on the date of the invitation for bids, form a part of this specification.

ASTM A 615	Deformed Billet-Steel Bars for Concrete Reinforcement
NFPA No. 70	National Electrical Code

(Copies of this specification and other applicable specifications and drawings may be obtained from the Contracting Officer in the Federal Aviation Administration Office issuing the invitation for bids. Requests should fully identify material desired, i.e., specification, amendment, and drawing numbers and dates. Requests should cite the invitation for bids or contract involved or other use to be made of the requested material.)

(Copies of ASTM publications may be obtained from the American Society for Testing and Materials, 1916 Race St., Philadelphia, Pa.)

(Information on obtaining copies of the National Electrical Code may be obtained from the National Fire Protection Association, 60 Battery-march Street, Boston, Massachusetts 02110.)

1-1.3 General Requirements

1-1.3.1 Work to be accomplished.- The contractor shall furnish all plant, labor, material, equipment, and transportation necessary to construct all elements of a complete ASR-7 facility, as required by the Contract Schedule. Installation of electronic equipment is not included. Elements of work are as follows:

(1) Clearing, excavation, filling, and grading.
(2) Driveway and parking surfaces, culverts and fences.
(3) Antenna tower foundations and erection.
(4) Transmitter/receiver building foundations
(5) Engine-generator van foundation, van installation, and fuel tank installation.
(6) Transformer substation.
(7) Underground duct and conduit and handholes.
(8) Power cable installations.
(9) Radar cable installation from T/R building to display site.
(10) Antenna system erection.
(11) Building system installation.

All of these elements are not necessarily required for each facility. The elements of work to be accomplished are called for in the Contract Schedule. This specification is suitable for individual procurement of elements 10 and 11, separate from the site preparation work covered by elements 1 through 9.

1-1.3.2 Site.- Any special conditions that pertain to the specific site for which this specification is used will be provided in the form of an addendum or an appendix to the specification.

1-1.3.3 Construction limits and access.- The contractor, in cooperation with the Contracting Officer's Representative, shall define the construction limit lines and approach route to the site. Limit lines shall indicate boundaries for storage areas, drives, temporary structures, parking, etc. The contractor shall coordinate his work methods and schedules with the Contracting Officer's Representative to cause a minimum of interference with, disruption, or interruption of airport operations or operations of existing government facilities.

1-1.3.4 Protection of work.- The contractor shall be responsible for the proper care and protection of all materials delivered and work performed until final acceptance, and he shall be responsible for repairs and replacements of new or existing materials or equipment damaged as a result of inadequate protection.

1-1.3.5 Government furnished materials.- All material not specifically indicated as furnished by the government in the Contract Schedule shall be furnished by the contractor. When government furnished materials are turned over to the contractor, it shall be the contractor's repsonsibility to see that the materials are in good condition and of sufficient quantity to accomplish the installation required. Should the contractor find that insufficient quantities of government furnished material are supplied, he shall immediately notify the Contracting Officer's Representative in writing so that additional quantities may be procured without delaying completion of the job. After the contractor has accepted the materials from the government, any materials damaged or lost will be charged to the contractor. Material and equipment furnished by the government in excess of that required to complete the installation shall be returned to the Contracting Officer's Representative at the completion of the construction.

1-1.3.6 Clean-up.- The contractor shall clean the work area during and immediately upon completion of his work, and shall remove all rubbish, waste, tools, equipment, and other apparatus caused by or used in the execution of his work. When as directed, and before final inspection, the contractor shall thoroughly clean the tower, substation, handholes, building exteriors, and areas of the building interiors affected by his work.

DIVISION 2. SITE WORK

2-1 General.- The contractor shall furnish all plant, labor, and material required to clear the site, excavate, backfill, grade, and seed the site, and construct a driveway, parking area, fences, cable trenches, handholes, and fuel tank.

2-2 Materials

2-2.1 Fill and Backfill.- Shall be clean earth of well graded coarse granular material free of organic, frozen, expanding, or shrinking material.

2-2.2 Driveway and parking surface.- Shall be in accordance with Specification FAA-C-95.

2-2.3 Seed.- Shall be types and mixture directed by the Contracting Officer's Representative.

2-2.4 Fence.- Shall be in accordance with Specification FAA-E-2065 for the class specified in the Contract Schedule.

2-2.5 Fuel tank.- The fuel tank, fittings, and guard posts shall be in accordance with Specification FAA-C-1244.

2-2.6 Culverts.- Shall be in accordance with Specification FAA-C-95 for the type specified in the Contract Schedule.

2-2.7 Steel conduit.- Shall conform to Specification FAA-1391.

2-3 Construction

2-3.1 Clearing and grubbing.- The contractor shall perform all necessary clearing and grubbing in the fenced area shown on Drawing D-5825 in accordance with paragraph 3.3.2 of Specification FAA-C-95. All trees shall be cleared away from guys, whether inside or outside of the fence, for a sufficient distance to prevent them from falling on the guy cable or it's anchor.

2-3.2 General excavation.- All materials, natural or artificial, the removal of which are deemed necessary by the Contracting Officer's Representative, shall be removed to a minimum depth of one foot below finish grade and disposed of by the contractor.

2-3.3 Foundation excavations.- Foundation excavations may be enlarged to permit forming of concrete or excavated to the exact size of the concrete member. The sides of the unformed excavation shall be maintained to withstand sloughing during the placing of concrete. All foundations shall bear on undisturbed soil unless foundation material is rock. All material, including weathered and loose rock which can be loosedned and removed by pick and shovel, shall be classified as "earth excavation." All rock and hardpan requiring drilling and blasting shall be classified and paid for as "rock excavation." Rock excavation shall be measured for payment from its top surface to three inches below the required grade with vertical sides one foot from the faces of the concrete foundation. No allowance will be made for "rock excavation" unless authorized in writing by the Contracting Officer's Representative prior to making excavation. Failure to obtain advance approval will be considered as waiver for all claims based upon classification of excavation. Authorization of payment for rock excavation shall not be grounds for extension of the contract time. Rock excavation shall be leveled to a clean, even, hard surface. In the event excavation reveals potential foundation bearing surfaces of part rock and part soil, the contractor shall remove the soil and fill the voids with concrete to the elevations required.

2-3.4 Fill and backfill.- Fill and backfill shall be placed in evenly distributed one (1) foot layers over the entire areas, properly moistened, and thoroughly consolidated by power operated mechanical equipment to prevent subsequent settlement. Fill for seeded areas shall be brought to within 6-inches of the final finished grade to allow for topsoil placement. Excess material shall be disposed of as directed by the Contracting Officer's Representative.

2-3.5 Topsoil.- Topsoil, previously stripped from the excavation areas and stockpiled, shall be placed on fill areas which are to be seeded. The topsoil shall be spread in a uniform 6" layer, properly graded, and rolled for compaction.

2-3.6 Seeding.- The area to be seeded shall be pulverized to a depth of 6-inches and raked to remove all lumps. Moisture may be added to provide a suitable planting surface. The seed shall be uniformly distributed at a rate directed by the Contracting Officer's Representative. Sowing shall be done in two equal quantities at right angles to one another. Cover seed lightly by raking and compact soil bed by rolling.

2-3.7 Grading.- The site shall slope away from the center of the transmitter/receiver building a 1/4" per foot or more. Ditches necessary to drain water away from the structures shall have side slopes of 4:1 wherever practicable.

2-3.8 Fence.- A fence shall be constructed around the site as shown on Drawing D-5825.

2-3.9 Driveway and parking area.- Construction shall be in accordance with Specification FAA-C-95 and located as shown on Drawing D-5825 and directed by the Contract Schedule.

2-3.10 Underground cable work.- Cable runs shall be located as shown on Drawing D-5825 and directed by the Contract Schedule. Construction shall be in accordance with Specification FAA-1391. Backfilling shall be placed and compacted with care to prevent damage or dislocation of conduit or cables. Underground direct burial metal conduits shall be installed from the proposed location of the radar cable junction box on the inside wall of the building to the nearest handhole as shown on Drawing D-5825 and D-4780. Standard radius bends may be used.

2-3.11 Fuel tank.- A 1000 gallon underground diesel fuel tank, as shown on Drawing D-5825, shall be furnished and installed in accordance with Specification FAA-C-1244.

2-3.12 Handholes.- Handholes shall be located as shown on Drawing D-5825 and directed by the Contract Schedule. Unless otherwise indicated or specified, each handhole shall be of double compartment type, with one compartment for power and the other for control cables

as shown on the detail drawings. The 6-inch gravel base for handholes shall provide drainage of handhole and suitable surface for coiling of excess cable. Gravel beneath handhole walls shall be well tamped so as to provide a firm bearing surface.

DIVISION 3. CONCRETE

3-1 General.- The contractor shall furnish all plant, labor, and material required to construct foundations for a tower, building, van, and substation, underground duct envelopes, culverts, and handholes.

3-2 Materials

3-2.1 Concrete.- Concrete for the transformer pad, handholes, and duct envelope shall conform to Specification CAA-566 for Class I concrete. Concrete for tower, building, and van foundations and culverts shall conform to Specification CAA-566 for Class II concrete having a 28 day strength of not less than 3000 pounds per square inch.

3-2.2 Reinforcing steel.- Deformed bars, Grade 40 or better, shall conform to ASTM A 615.

3-2.3 Steel conduit.- Shall conform to Specification FAA-1391.

3-2.4 Fiber duct.- Shall conform to Specification FAA-1391.

3-3 Construction

3-3.1 Placing concrete.- Concrete construction shall be in accordance with Specification CAA-566. Care shall be taken that steel reinforcing, conduits, or duct are not displaced during placing of concrete.

3-3.2 Reinforcing steel.- Steel shall be placed as shown on the drawings. Concrete or metal chairs or spacers shall be used to accurately place and adequately secure the reinforcement, and concrete shall not be poured before the reinforcing has been inspected and approved by the Contracting Officer's Representative.

3-3.3 Concrete loading.- Concrete shall be at least seven (7) days old before loads are placed on it, steel erection is started, or backfill is started. If high-early strength Portland cement is used, the concrete shall be at least three (3) days old.

3-3.4 Concrete foundations.- Foundations shall be constructed as shown on the applicable drawings provided that the Contracting Officer's Representative may order the footings carried down farther than indicated on the applicable drawings if necessary to get soil of proper bearing value. In such case, the additional excavation and material will be paid for at a unit price corresponding to the contract price. If solid rock is encountered the Contracting Officer's Representative may order redesign of the footings in order to avoid excavating rock and refilling with concrete. Concrete shall be Class II.

3-3.5 Fuel tank anchors.- Concrete fuel tank anchors shall be constructed from Class I concrete in accordance with Specification FAA-C-1244.

3-3.6 Culvert headwalls.- Concrete headwalls shall be constructed from Class II concrete in accordance with FAA-C-95.

3-3.7 Substation pad.- A concrete substation pad shall be constructed from Class I concrete in accordance with Drawing C-5186. Concrete shall be placed on undisturbed soil, if possible. Fill under concrete shall be well tamped before concrete is placed. Concrete foundations for the pad shall be carried below the frost line as determined by the Contracting Officer's Representative. The finished surface of the pad shall slope slightly toward the edges to shed water. The steel conduit risers and substation anchorage shall be positioned by the contractor in accordance with the equipment furnished.

3-3.8 Handholes.- Reinforced concrete handholes shall be constructed from Class I concrete in accordance with Drawings D-4780 and D-4863-1.

3-3.9 Underground duct.- Bituminous fiber ducts shall be encased in Class I concrete in accordance with Drawings D-5825, D-4780, and D-4863-1 and Specification FAA-1391.

DIVISION 5. STRUCTURAL METAL

5-1 General.- The contractor shall furnish all plant, labor, and material required to erect a government furnished radar antenna tower and construct the transmitter/receiver building foundation.

5-2 Materials

5-2.1 Tower.- The size of tower to be furnished by the government will be indicated in the Contract Schedule.

5-2.2 Building foundation.- Structural steel items shall be fabricated in accordance with Drawing Series D-5826.

5-3 Construction

5-3.1 Tower.- The tower shall be erected in accordance with Specification FAA-1247 and applicable drawings of Series D-5419 and D-5453.

5-3.2 Building foundation.- The steel building foundation structure shall be constructed in accordance with Drawing Series D-5826.

DIVISION 13. SPECIAL CONSTRUCTION

13-1 General.- The contractor shall furnish all plant, labor, and material required to handle, lift, and install a government furnished engine-generator van. If required by the Contract Schedule, the Contractor shall furnish all plant, labor, and material required to set in place and secure a government furnished antenna system and install a government furnished dual channel transmitter/receiver building.

13-2 Materials

13-2.1 Engine-generator van.- The government furnished van and installed equipment will generally conform to Drawing D-5816-1.

13-2.2 Batteries and rack.- Starting batteries and a battery rack shall be furnished in accordance with Specification FAA-C-1244 and as required in the Contract Schedule.

13-2.3 Antenna system.- The government furnished antenna system will consist of the following components and weights (approximate). Pedestal - 1600 lb., reflector support - 300 lb., reflector - 425 lb., feed support - 130 lb., feed horn - 95 lb., and miscellaneous items.

13-2.4 Transmitter/Receiver Building.- The government furnished transportable building will be provided in two units, each nominally 40' long, 10' wide, and 10'-6" high. Each unit will weigh approximately 20,000 lbs. at the time of installation. Each complete building will be provided with hardware for joining and sealing the two units, detachable building skirts, two sets of steps and door canopys, and hardware for finishing openings between the two units.

13-3 Construction

13-3.1 Engine-generator van.- The van shall be installed as shown on Drawings D-5816-1 and 3. The contractor shall position the van on the foundation and secure it. Fuel line connections shall be completed in accordance with Specification FAA-C-1244. The contractor shall furnish and install starting batteries and a battery rack in accordance with Specification FAA-C-1244 and as required in the Contract Schedule.

13-3.2 Antenna system.- The contractor shall rig, lift, place, and secure the individual components of the antenna system on top of the antenna tower. The antenna system shall be installed level, plumb, and true in accordance with the detailed instructions of the Contracting Officer's Representative.

13-3.3 Transmitter/Receiver Building.- The building shall be installed as shown on Drawings D-5825 and Series D-5826 and in accordance with the manufacturer's installation instructions. The contractor shall position the building units on the foundation structure, join the units together, and accomplish all sealing required to provide a weatherproof building. Steps, door canopys, closures for connecting duct and door openings, skirts around foundation, and all other detached items shall be installed. Each unit contains delicate electronic equipment and shall not be subjected to handling, movement, or impact which is more severe than that normally experienced during over-the-road delivery to the installation site. Care shall be taken to not remove packing, bracing, or ballast from the equipment before the units are secured in place.

DIVISION 16. ELECTRICAL

16-1 General.- The contractor shall furnish all plant, labor, and material required to provide electric service to the substation, engine-generator system, building, and tower, including wiring and conduit; construct and connect a complete grounding system for the facility; and install radar data remoting cables. Electrical work in the transmitter/receiver building shall be accomplished only if the contractor is required by the Contract Schedule to install the building in accordance with Division 13 of this specification.

16-2 Materials

16-2.1 Substation.- Shall conform to Specification FAA-E-2022. Shall be government furnished or contractor furnished, as required in the Contract Schedule.

16-2.2 Engine-generator system.- A fully automatic engine-generator set with all necessary associated switchgear and hardware, completely installed and wired in a van type housing, will be furnished by the government. The type and rating are shown on Drawing D-5825.

16-2.3 Electrical conduit and fittings.- Shall be in accordance with Specification FAA-C-1217.

16-2.4 Radar cables.- Shall be furnished by the government in the lengths required. The types of cable are shown on Drawing D-5825.

16-2.5 Power cable.- Shall be furnished by the government in the lengths required or furnished by the contractor as required and specified in the Contract Schedule. The type and rating of cables shall be as shown on Drawing D-5825.

16-3 Construction

16-3.1 Substation.- A metal clad transformer substation shall be installed in accordance with Drawing D-5468-2. The incoming and outgoing wiring shall be installed as shown on Drawing D-5825 and in accordance with the requirements of the National Electrical Code and local power company requirements.

16-3.2 Engine-generator system.- The contractor shall install and connect the van housed engine-generator system in accordance with Drawings D-5825 and D-5816-1 and all applicable portions of Specification FAA-C-1244.

16-3.3 Transmitter/Receiver Building.- All wiring shall be installed between the engine-generator system and the distribution panel board in the building as shown on Drawing D-5825 and in accordance with FAA-C-1217. All power wiring, conduit, and raceways required to interconnect the two building units shall be installed in accordance with the manufacturer's instructions and FAA-C-1217. The main distribution panel boards in both building units shall be energized.

16-3.4 Tower.- Galvanized conduit wireways shall be provided from transmitter/receive building to the radar antenna tower as shown on Drawing Series D-5419. The wireways shall enter the building wall approximately 8'-8" above the elevations of the building foundation piers. Provision for drainage of condensation from conduit shall be made at the lowest point of conduit run. Conduit entrance to the pull box shall be made weathertight as indicated. Conduits shall be utilized in the manner specified on the drawings. If more than one circuit is to run in any one conduit, all circuits shall be installed at the same time. Wiring shall be as specified on the drawings. Circuits shall be continuous from the tower cable junction box to the building entrance. The allowance for termination on each conductor or cable shall be 35' at the tower cable junction box and 30' at the building entrance. Wires shall be supported at the top of the vertical conduit runs to relieve the electrical connections from the strain of the conductor weight. All provisions of the National Electrical Code shall be followed in making the installation. The termination of cables and conduit for connection to the building shall be provided temporary support as directed by the Contracting Officer's Representative. The waveguide will be furnished and installed by others.

16-3.5 Grounding.- Each component of the total radar facility, including substation, engine-generator system, building, tower, and handholes shall be grounded in accordance with applicable construction and installation drawings and Specification FAA-C-1217. The building electrical and electronic equipment shall be grounded in accordance with manufacturer's instructions. The ground rods of the tower, building, van, and substation shall be interconnected in accordance with Specification FAA-C-1217.

16-3.6 Underground cable installation.- All underground radar and power cables shall be installed as shown on Drawing D-5825 and in accordance with FAA-1391. The cable run shall terminate at the exterior wall of the radar display site, as specified in the Contract Schedule.

16-3.6.1 Radar cable.- Radar cables of the type and number furnished by the government shall be installed in duct, conduit, or direct burial from the radar cable junction box in the transmitter receiver building to the radar display site.

16-3.6.2 Power cable.- Power wires and cables shall be installed as shown on Drawing D-5825 and in accordance with Specification FAA-1391. All exposed current carrying conductors shall be suitably insulated for full voltage insulation. Exposed outdoor conductors shall have a weather resistant finish. Power cables installed in ducts or conduit shall be as far removed from radar control cables as possible. Power cables shall enter only the power compartment of handholes.

16-4 Quality Assurance.- All wiring accomplished by the contractor shall be tested in accordance with paragraph 4.1 of Specification FAA-C-1217. The ground system shall be tested in accordance with paragraph 4.2 of Specification FAA-C-1217.

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